

## **APPENDIX C**

# LABORATORY TEST RESULTS FOR OIL SAMPLES FROM WELLS EE-11 AND BR-I AND GROUNDWATER SAMPLE FROM WELL BR-G

- C.1 Physical Properties and Chemical Composition of Oil Sample from Well EE-11
- C.2 Physical Properties and Chemical Composition of Oil Sample from Well BR-I
- C.3 Chemical Composition of Groundwater Sample from Well BR-G



GSI Job No. G-2876 Issued: January 21, 2005

# APPENDIX C.1 PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL EE-11

C.1 Physical Properties and Chemical Composition of Oil Sample from Well EE-11(2 pages)

Table C-1: Chemical Composition of Oil Sample from Well EE-11 (5 pages)

Physical properties testing results from PTS Laboratories (3 pages)

ASTM D86 Distillation Test results from SPL, Inc. (2 pages)

High Temperature Simulated Distillation (HTSD) results from Triton Analytics Corp. (10 pages)

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# C.1 PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL EE-11

On May 19, 2004, personnel from Groundwater Services, Inc. (GSI) collected a sample of oil from well EE-11, which is located at Site G. The oil was reported to have dark brown color and the consistency of motor oil. Results of field measurements indicated a specific gravity of 0.94 and viscosity of 26.9 centistokes at a temperature of 78 °F. The specific gravity measurement and visual observations confirmed that the oil is an LNAPL.

Two 40-mL vials of the oil sample from EE-11 were submitted to Severn Trent Laboratories in Savannah, Georgia, for laboratory analysis of VOCs, SVOCs, pesticides, herbicides, PCBs, dioxins/furans, and metals. Analytical results are presented on Table C-1 and summarized below. Less than one percent of the sample composition by weight was identified by these analytical methods. Copies of laboratory reports are attached.

Chemical Constituents in	Reported Concentration	Weight				
Oil Sample from EE-11	(mg/kg)	Fraction (%)				
VOCs (total)	829	0.083				
SVOCs (total)	3300	0.33				
Pesticides (total)	153	0.015				
Herbicides (total)	31	0.003				
PCBs (total)	2600	0.26				
Dioxins/Furans (total)	32 *	0.003				
Metals (total)	1580	0.16				
Total Weight Fraction for Identified Constituents: 0.85%						

A liter bottle containing groundwater and oil was submitted for laboratory analysis of fluid properties at PTS Laboratories in Santa Fe Springs, California. The sample was tested using ASTM D445 and ASTM D1481, which include measurement of: i) dynamic viscosity and fluid density at three temperatures; ii) surface tension for each fluid; and iii) interfacial tension for oil/water, oil/air, and water/air. Results of laboratory testing of the LNAPL sample indicated a specific gravity of 0.89 and viscosity of 26.4 centistokes at a temperature of 70 °F.

An additional volume of sample was submitted to SPL, Inc. of Houston, Texas, for analysis by ASTM Method D86 Distillation. Initial boiling point of the oil was 517 °F, and final boiling point was 700 °F, at which temperature the sample experienced decomposition.

A liter of oil and water was retained under refrigeration by GSI. A vial of oil taken from the liter bottle was submitted to Triton Analytics Corporation of Houston, Texas, on



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August 9, 2004 for High Temperature Simulated Distillation (HTSD). The HTSD test is a GC technique that separates individual hydrocarbon components in the order of their boiling points, giving a percent mass yield as a function of boiling point. The HTSD test can be used to determine the carbon number distribution up to C120.

Prior to conducting the HTSD test, Triton Analytics centrifuged the contents of the vial for ten minutes to isolate the oil layer. Triton Analytics reported that the boiling characteristics of the oil layer from the sample showed a significant amount of hydrocarbon compounds in the diesel range. A minor second boiling region of material was observed in the C23 carbon number range, which is more characteristic of a vacuum gas oil or heavier oil.

**Key Findings**: The oil sample collected from well EE-11 was determined to be an LNAPL. Chemical constituents identified by various analytical methods comprised less than one percent of the sample by weight. The boiling characteristics of the oil sample showed a significant amount of hydrocarbon compounds in the diesel range. A minor second boiling region of material was observed in the C23 carbon number range, which is more characteristic of a vacuum gas oil or heavier oil.

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# TABLE C-1 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL EE-11

COMPOUND	CAS No.	Rosult	Units
Volatile Organic Compounds (VOCs) By EPA Method 8260			
Acetone	67-64-1	<250	mg/kg
Benzene	71-43-2	44	**
Bromodichloromethane	75-27-4	<25	**
Bromoform	75-25-2	<25	96
Bromomethane	74-83-9	<25	**
Carbon disulfide	75-15-0	<b>-2</b> 5	*
Carbon tetrachloride	56-23-5	<25	-99
Chlorobenzene	108-90-7	710	#
Chloroethane	75-00-3	<25	**
Chloroform	67-66-3	<25	
Chloromethane	74-87-3	<25	
Dibromochloromethane	124-48-1	<25	**
Dichloroethane, 1,1-	75-34-3	<25	*
Dichloroethane, 1,2-	107-06-2	<25	34
Dichloroethene, 1,1-	75-35-4	<25	.\$4
Dichloroethene, cis-1,2-	156-59-2	7.9J	***************************************
Dichloroethene, trans-1,2-	156-60-5	₹25	**
Dichloropropane, 1,2-	78-87-5	<25	**
Oichloropropene, cis-1,3-	10061-01-5	<25	**
Dichloropropene, trans-1,3-	10061-02-6	<25	*
Ethylbenzene	100-41-4	27	
Hexanone, 2-	591-78-6	<120	Ħ
Methyl ethyl ketone (2-Butanone)	78-93-3	<120	**
Methyl-2-pentanone, 4-	108-10-1	<120	**
Methylene chloride	75-09-2	<25	**
Styrene	100-42-5	<25	te to the state of
Tetrachloroethane, 1,1,2,2-	79-34-5	<25	**
Tetrachloroethene	127-18-4	13J	**
Toluene	108-88-3	5,8J	**
Trichloroethane, 1,1,1-	71-55-6	<25	**
Trichloroethane, 1,1,2-	79-00-5	<25	A ASSESSION COSSION CONTRACTOR IN SECURITION OF SECURITION
Trichloroethene	79-01-6	<25	**
Vinyl chloride	75-01-4	<25	69
Xylenes (total)	1330-20-7	21J	.89
Total VOCs		828.7	mg/kg

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# TABLE C-1 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL EE-11

COMPOUND	CAS No.	Result	Units
Semivolatile Organic Compounds (SVOCs) By EPA N			
Acenaphthene	83-32-9	<860	mg/kg
Acenaphthylene	208-96-8	<860	**
Anthracene	120-12-7	<860	-94
Benzo(a)anthracene	56-55-3	<860	<del>\$9</del>
Benzo(a)pyrene	50-32-8	120J	鄉
Benzo(b)fluoranthene	205-99-2	<860	
Benzo(ghi)perylene	191-24-2	180J	<b>98</b>
Benzo(k)fluoranthene	207-08-9	<860	**
Bis(2-chloroethoxy) methane	111-91-1	<860	<b>89</b> 2
Bis(2-chlorethyl)ether	111-44-4	<860	**
Bis(2-ethylhexyl) phthalate	117-81-7	<860	a special seguence of second resolution of comments of the comments of the contract of the contract of the comments of the contract of the con
Bromophenyl phenyl ether, 4-	101-55-3	<860	189
Butylbenzyl phthalate	85-68-7	<860	ås
Carbazole	86-74-8	<860	**
Chloro-3-methylphenol, 4-	59-50-7	<860	海岸
Chloroaniline, 4-	versenniko-uzuwenokolokolokolokolokolokolokolokolokoloko	410J	$\frac{84}{40000000000000000000000000000000000$
Chloronaphthalene, 2-	91-58-7	<860	89
Chlorophenol, 2-	95-57-8	<860	50°
		1	**
Chlorophenyl phenyl ether, 4-	7005-72-3	<850	- 10
Chrysane	218-01-9	440.1	**************************************
Dibenz(a,h)anthracene	53-70-3	97.J	***
Dibenzofuran	132-64-9	<860	40
Dichlorobenzene, 1,2-	95-50-1	130J	*** 
Dichlorobenzene, 1,3-	541-73-1	<860	99
Dichlorobenzene, 1,4-	106-46-7	150J	
Dichlorobenzidine, 3,3'-	91-94-1	<1700	*
Dichlorophenol, 2,4-	120-83-2	<860	Ħ
Diethylphthalate	84-66-2	<860	99
Dimethylphenol, 2,4-	105-67-9	<860	**
Dimethyl phthalate	131-11-3	<860	199
Di-n-butyl phthalate	84-74-2	<860	≱
Dinitro-o-Cresol, 4,6-	534-52-1	<4400	<b>3</b> 8
Dinitrophenol, 2,4-	51-28-5	<4400	<b>\$</b> \$
Dinitrotoluene, 2,4-	121-14-2	<860	<del>91</del>
Dinitrotoluene, 2,6-	606-20-2	<860	\$ <del>2</del>
Di-n-octyl phthalate	117-84-0	850J	**************************************
Dinoseb	88-85-7	<860	49
Fluoranthene	206-44-0	<860	**
Fluorene	86-73-7	<860	**
Hexachlorobenzene	118-74-1	<860	ş*
Hexachiorobutadiene		<860	annon accommensaria de la compania del la compania de la compania del la compania de la compania del la compania de la compani
Hexachlorocyclopentadiene	77-47-4	<860	366
Hexachloroethane	67-72-1	<860	99
indeno(1,2,3-cd)pyrene	193-39-5		**
		110J	*
Isophorone		<860	

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# TABLE C-1 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL EE-11

COMPOUND	CAS No.	Result	Units
Semivolatile Organic Compounds (SVOCs) By EPA Method			
Methylnaphthalene, 2-	91-57-6	<860	mg/kg
Cresol, o-	95-48-7	<860	in the state of th
Cresol, p-	106-44-5	<860	**
Naphthalene	91-20-3	<860	**
Nitroaniline, 2-	88-74-4	<4400	39
Nitroaniline, 3-	99-09-2	<4400	and the second s
Nitroaniline, 4-	100-01-6	<4400	ĝ
Nitrobenzene	98-95-3	<860	*
Nitrophenol, 2-	88-75-5	<860	*
Nitrophenol, 4-	100-02-7	<4400	\$P\$
N-nitrosodi-n-propylamine	621-64-7	<860	##
Nitrosodiphenylamine, N-	86-30-6	<860	#4
Pentachlorophenol	87-86-5	<4400	*9
Phenanthrene	85-01-8	<860	**
Phenol	108-95-2	<860	94
Pyrene	129-00-0	360J	
Trichlorobenzene, 1,2,4-	120-82-1	450J	iga -
Trichlorophenol, 2,4,5-	95-95-4	<860	-88
Trichlorophenol, 2,4,6-	88-06-2	<860	191
Total SVOCs	riettivitiitiitiitiitiitiitiitiitiitiitiiti	3297	
Metals By EPA Method 6010			ENTERGIS OF SOME EXPONENTATION
Aluminum	7429-90-5	39	mg/kg
Antimony	7440-36-0	<1.90	*0
Arsenic	7440-38-2	<.93	189
Banum	7440-39-3	310	**
Beryllium	7440-41-7	<.37	<del>10</del> 9
Cadmium	7440-43-9	0.208	and the first and an execution of the state of
Calcium	7440-70-2	300	99
Chromium	7440-47-3	270	*
Cobalt	7440-48-4	1.1	*
Copper	7440-50-8	0.60B	**
Iron	7439-89-6	140	111001-1-10-101111111-1111111111111111
Lead	7439-92-1	380	##
Magnesium	7439-95-4	8.7B	**
Mercury	7439-97-6	0.026B	99
Nickel	7440-02-0	43	**
Potassium	7440-09-7	298	***************************************
Selenium	7782-49-2	<.93	99
Silver	7440-22-4	<.93	**
Sodium	7440-23-5	368	**
Thallum	7440-28-0	<.93	e latintat del di tradit de de la latinta de la maior de mandro la militar de la companie con communicación de La companie de la companie del la companie de la companie del la companie de la compa
Vanadium	7440-62-2	6.6	**
Zinc	7440-66-6	15	**
Total Metals		1579	mgkg

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# TABLE C-1 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL EE-11

COMPOUND	CAS No.	Result	Units
Pesticides By EPA Method 8081			An encomple of property and the second second
Aldrin	309-00-2	<0.25	mg/kg
alpha-BHC	319-84-6	<0,25	98
beta-BHC	319-85-7	< 0.25	***
Gamma-BHC (Lindane)	58-89-9	<0,25	59) 51)
delta-BHC	319-86-8	< 0.25	**************************************
alpha Chlordane	5103-71-9	<0.25	*
Gamma Chlordane	5103-74-2	<0.25	**************************************
4,4'-DDD	72-54-8	61P	## ##
4,4'-DDE	72-55-9	4P	99
4,4'-DDT	50-29-3	88P	**
Dieldrin	60-57-1	<0.50	The state of the s
Endosullan I	959-98-8	<0.25	**
Endosulfan II	33213-65-9	<0.50	89
Endosulfan sulfate	1031-07-8	<0.50	**
Endrin	72-20-8	<0.50	29
Endrin aldehyde	7421-93-4	<0.50	
Endrin ketone	53494-70-5	<0.50	\$99
Heptachlor	76-44-8	<0.25	神学
Heptachior epoxide	1024-57-3		gueuro, emmentration in transcription in france, or construction of emperature and emperature an
Methoxychlor	72-43-5	<2.5	**
Toxaphene	8001-35-2	<25	HB
Total Pesticides	teranicalini teranggan teranggan teranggan teranggan teranggan teranggan teranggan teranggan teranggan terangg	153	rng/kg
Chlorinated Herbicides By EPA Method 8151			
2.40:	94-75-7	<0.083	mg/kg
Dalapon	75-99-0	<20	***
2.4-DB	94-82-6	<0.083	35%
Dicamba	1918-00-9	<.2	· 特別
Dichloroprop	120-36-5	<1	***
MCPA	94-74-6	<20	
MCPP	7085-19-0/ 93-65-2	<20	ķė
Pentachlorophenol	87-86-5	31	**
2,4,5-T	93-76-5	<0.083	<b>#</b> #
2,4,5-TP (Silvex)	93-72-1	<0.083	**
Total Chlorinated Herbicides	danikasi Adriani kihalam Massi kasa Kihana dari da kelasan energi kendenasa kendenasa kelasa melekina terbeke k Massi kendenasa kend		rrg/kg
Polychlorinated Biphenyls (PCBs) By EPA Method 8082			Company of the Compan
Aroclor 1016	12674-11-2	<5	nig/kg
Aroclor 1221	11104-28-2	<10	*
Araclar 1232	11141-16-5	<b>&lt;</b> 5	kø.
Aroclor 1242	53469-21-9	87	98
Aroclor 1248	12672-29-6	<u> </u>	<del>e mario e e en esta en mario e en el como esta el como el como M</del>
Aroclor 1254	11097-69-1	870P	
Aroclor 1254 Aroclor 1260	11097-69-1 11096-82-5	870P 1600P	**

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## TABLE C-1 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL EE-11

## Sauget Area 1 Sauget and Cahokia, Illinois

COMPOUND	CAS No.	Result	Units
Dioxins and Furans By EPA Method 8280A			
2,3,7,8-TCDD	1746-01-6	<2.9	ng/g
Total TCDD	VACOUS CONTRACTOR CONT	<3.6	<b>99</b>
1,2,3,7,8-PeCDD	40321-76-4	<33	₹¢
Total PeCDD	State of the state	<33	19
1,2,3,4,7,8-HxCDD	39227-28-6	<10	**
1,2,3,6,7,8-HxCDD	57653-85-7	**************************************	## ## ## ## ## ## ## ## ## ## ## ## ##
1,2,3,7,8,9-HxCDD	19408-74-3	<27	**
Total HxCDD	Abriland	300	**
1,2,3,4,6,7,8-HpCDD	35822-39-4	2400	₩
Total HpCDD	The state of the s	4500	**
COD	3268-87-9	19000E	energennen werezoneren errentziaren 1900 en 19 Energennen werezoneren errentziaren 1900 en 19
2,3,7,8-TCDF	51207-31-9	<20	### T
Total TCDF	and for each fine and	<20	**
1,2,3,7,8-PeCDF	57117-41-6	<3.4	**
2,3,4,7,8-PeCDF	57117-31-4	<7.2	**
Total PeCDF		<20	39
1,2,3,4,7,8-HxCDF	70648-26-9	<59	**
1,2,3,6,7,8-HxCDF	57117-44-9	<17	<b>₩</b>
2,3,4,6,7,8-HxCDF	60851-34-5	<18	糖
1,2,3,7,8,9-HxCDF	72918-21-9	<10	<b>34</b>
Total HxCDF		400	(in the second s
1,2,3,4,6,7,8-HpCDF	67562-39-4	750	**
1,2,3,4,7,8,9-HpCDF	55673-89-7	78J	**
Total HpCDF	And Albert And	3500	#8
OCDF	39001-02-0	3900	<b>%</b>
Total Dioxins and Furans		31600	ng/g

#### Notes:

- 1. The oil sample was collected from EE-11 on May 19, 2004.
- 2. All analyses were conducted by Severn Trent Laboratories (STL), Savannah, Georgia, with the exception of dioxins and furans which were analyzed by STL, Sacramento, California. Detected analytes are presented in bold type.
- 3. J = Analyted detected below the reporting limit but above the method detection limit (MDL).
  - < = Analyte not detected at the specified reporting limit. B = Reported value was obtained from a reading that was less than the project reporting limit but greater than or equal to the method detection limit.
  - S = The reported value was determined by the method of standard additions (MSA).
  - E = Estimated result. Result exceeds the calibration range.
  - P = Identification of target analytes using GC methodology is based on retention time. Although two dissimilar GC columns confirmed the presence of target analyte in sample, relative percent difference is >40%. Thus, viewer discretion should be employed during data review and interpretation of results for this target compound.



June 24, 2004

James A. Kearley Groundwater Services, Inc. 2211 Norfolk, Suite 1000 Houston, Texas 77098

Re:

Fluid Properties Data PTS File No: 34379 Monsanto / Sauget Area 1

Dear Mr. Kearley:

Please find enclosed Fluid Properties Data from analyses conducted upon fluids received from your Monsanto / Sauget Area 1 project. An electronic version of the data has previously been sent to your attention via the Internet. All analyses were performed by applicable ASTM, EPA or API methodologies. The remaining fluids are currently in storage and will be disposed at sixty days from project completion.

PTS Laboratories, Inc. appreciates the opportunity to be of service. If you have any questions or require additional information, please give me a call at (562) 907-3607.

Sincerely.

PTS Laboratories, Inc.

Michael Mark Brady, R.G.

Project Manager

Encl.

## VISCOSITY, SPECIFIC GRAVITY and DENSITY DATA

(METHODOLOGY: ASTM D1481, ASTM D445, API RP40)

PROJECT NAME:

Monsanto / Sauget Area 1

PROJECT NO:

G-2876-104

CANPLE.		TEMP.,	SPECIFIC	DENSITY	VISCO	SITY
L io	MATRIX	(*F)	GRAVITY	(g/cc)	(centistokes)	(centipolse)
EE-11 NAPL	Water	70	1,0053	1,0033	1.005	1.009
		100	1.0041	0.9971	0.702	0.700
		130	1.0086	0,9944	0,528	0.525
EE-11 NAPL	NAPL	70	0.8917	0.8899	28.4	23.5
		100	0.8858	0.8796	12.5	11.0
		130	0.8831	0.8707	7.19	6.26

## INTERFACIAL / SURFACE TENSION DATA

(METHODOLOGY; DuNuoy Method - ASTM D971)

PROJECT NAME:

Monsanto / Sauget Area 1

PROJECT NO:

G-2876-104

PHASE SAMPLE ID / PHASE	: PAIR SAMPLE ID / PHASE	TEMP., (°F)	INTERFACIAL TENSION, (Dynes/centimeter)
EE-11 NAPL (Water)	Air	79	58.3
EE-11 NAPL (NAPL)	Air	79	29.8
EE-11 NAPL (Water)	EE-11 NAPL (NAPL)	79	15.4

### **QUALITY CONTROL DATA**

PHASE PAIR: DI WATER / AIR

TEMPERATURE, \*F: 79

IFT, MEASURED: 72.6

IFT, PUBLISHED: 71.8

RPD: 1.14



#### HOUSTON LABORATORY

8880 INTERCHANGE DRIVE HOUSTON, TEXAS 77054 PHONE (713) 660-0901

## Certificate of Analysis

Number:

1030-2004050236-001A

James Kearley

Groundwater Services, Inc. 2211 Norfolk Ste 1000 Houston TX 77098

May 20, 2004

Sample ID:

EE-11 NAPL

Monsanto / Sauget Area 1

Project Number:

Project Name:

G-2876

Sampled By:

Sample Of:

Sample Date:

Liquid

05/19/2004 10:15

Project Location: Sample Point:

Sample Conditions: PO / Ref. No:

## ANALYTICAL DATA

**ASTM D86 Distillation** 

% Recovery	* F @ 769 mm Hg	Lab Tech.	Date Analyzed
Initial Boiling Point	517	MES	05/20/04
5	530		
10	535		
20	542		
30	548		
40	556		
50	565		
60	576		
70	598		
80	640		
90	690		
95	NR		
Final Boiling Point	700		
Volume % Recovery	95		
Volume% Residue	5		
Volume % Loss	0		

Comments:

Visual color is dark straw. Loss and residue observed. Temperatures uncorrected for barometric

pressure. Sample experienced decomposition @ 700°F.

Hydrocarbon Laboratory Manager

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## 16840 Barker Springs #302 Houston, Texas 77084

(201) 578-2289 (281) 578-2295 villalanti@earthlink.net

Fax:



## Triton Analytics Corp.

Reference Laboratories

- Hvdrocarbon
- Chemical
- Environmental

Dan Villalanti. Pres. .

Joe Raia, Lab Director \* Calvin Blakley, Mass Spec \*

Jeanne Malloy, GC

September 15, 2004

Laboratory Reference: TAC 3895(A)

James Kearley Groundwater Services, Inc. 2211 Norfolk, Suite 1000 Houston, TX 77098

Dear Mr. Kearley:

The High-temperature Simulated Distillation (HTSD) results for your sample identified below are enclosed and were reported to you earlier by Email 8/10/04.

EE-11 Oil from Monitoring Well

The boiling characteristics of this sample did not show any significant contribution of hydrocarbon materials in the range of gasoline, kerosene or jet fuel, however there was a significant portion of material in the diesel range as shown in the overlay HTSD chromatogram of the sample with a diesel fuel sample. There is also a second boiling region of material present in the C23 carbon number range which is more characteristic of a vacuum gas oil or heavier oil.

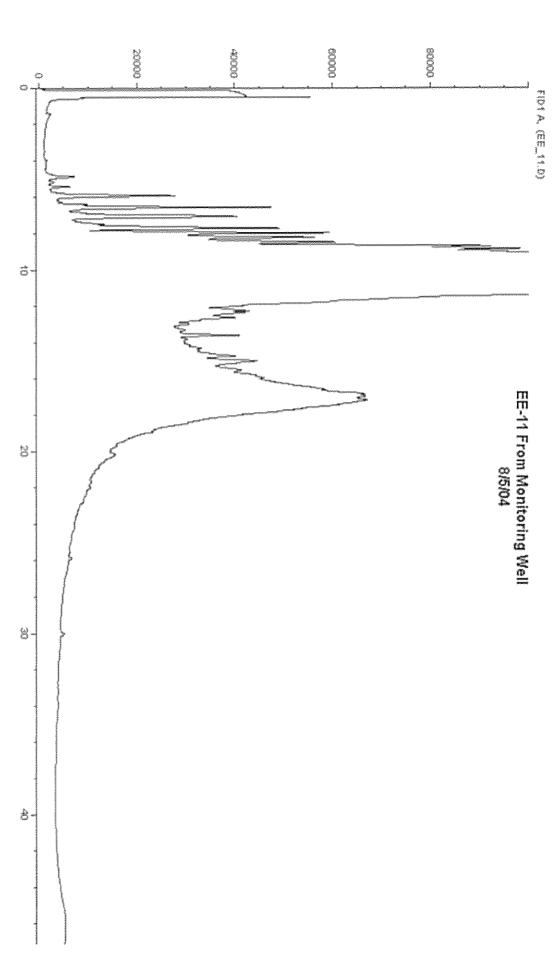
When we received the sample it appeared homogenous, but also appeared to contain some water. Prior to sampling we centrifuged the sample for 10 minutes to isolate the hydrocarbon layer. The proportion of water to hydrocarbon present is shown in the enclosed photograph of the vial of the centrifuged sample. Please note in the photo some sediment at the bottom of the vial which we tested but did not appear to be magnetic. Also included in this data package for reference are an illustration of the distillation characteristics of fuels and a table of properties of typical crude oil fractions.

Thank you and please let us know if you have any questions.

Regards.

Dan C. Villalanti

DCV/icr Enclosures



------- AC Software version M2.5 -------Simdis HT 750 Analyzer 

Data File Name: C:\HPCHEM\1\DATA\0809A\009F1201.D Vial : 9
Injection : 1
Seq. line : 12 Instrument : 1 Operator : Triton Analyt.
Acquired on : 09 Aug 04 09:53 PM
Processed on : 10 Aug 04 9:26 AM

Sample name : EE-11 RE MW Methodname : MHC30.MTH Sample Amt: 0.1024 ISTD amt : 0.0000 Calc. Based On: ESTO Welcht CS2: 4.8756

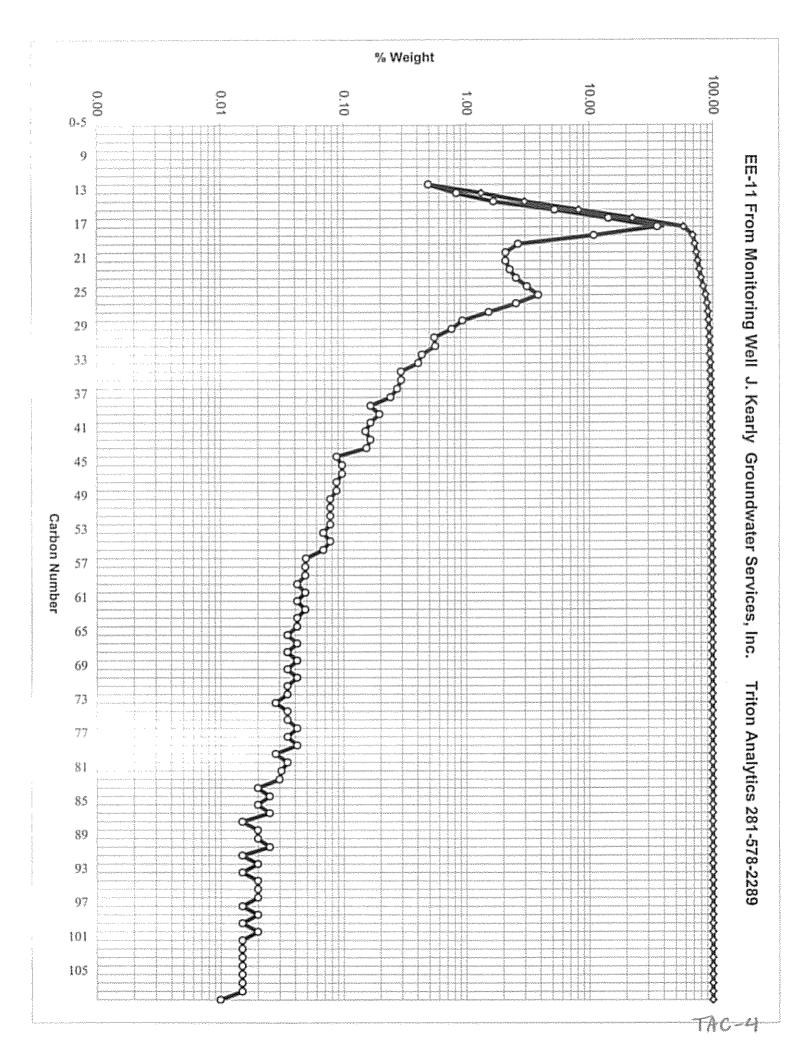
Sequencename : 0809A Cryogenic sequence

Blank used : C:\HPCHEM\1\DATA\0809A\008F1101.D BP Calib. used: C:\HPCHEM\1\DATA\0809A\090F0101.D Reference used: C:\HPCHEM\1\DATA\0809A\095F0301.D

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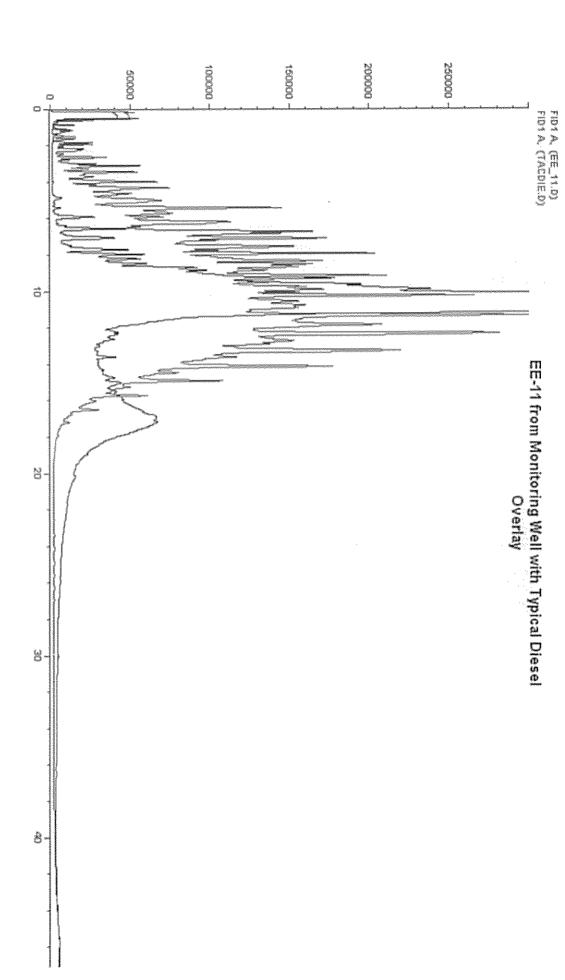
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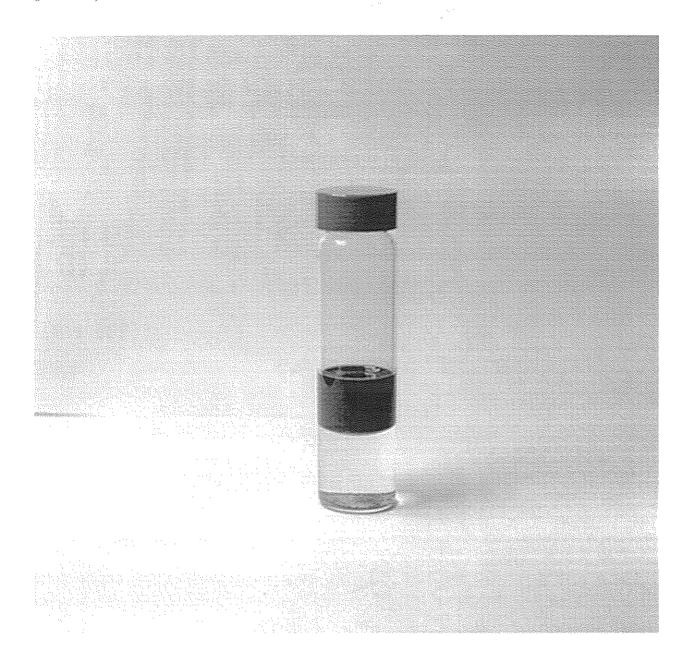


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anasanananasananasanasanasananasanasana	301.5	574.7	98	99	1105.2	1250.1	ő I	98.27	0.04	1145
-57	301.9	575.4	98	99	1105.2	1250.1	62	98.32	0.05	1152
en e	302.3	576.1	98	99	1105.2	1250.1	6,3	98.36	0.04	1158
annentititi entitette e e retere e tette e e e equite e tittitu e tittitu e etitite e e e e e e e e e e e e e e	and the second s	576,9	G8	99	1105,2	1250.1	64	98.41	0.04	1164
	303.1	577.6	98	99	1105.2	1250.1	65	98,44	0.03	1169
zavano esta esta esta esta esta esta esta esta	303.5	578.3	98	99	1105.2	1250.1	66	98.48	0.04	1175
rammanissassassassassassassassassassassassassa	oomere terreteris variat eta kalendari eta	579.2		99	1105.2	1250.1	67	98.52	0.03	1180
	304.6	580.3	98	99	1105.2	1250.1	68	98.56	0.04	1186
antiviteinistyvitein kantielaa aliterusti paenoti valoistaan proesti tiin oo o	305.3	581.5	98	99	1105.2	1250.1	69	98.59	0.03	1191
nativoratetratativi esteerivatementeleesementeleesen propegoraseemen propegoratesia in territorio alivatesia.		583.5	rangopalandologio de	99	1105,2	1250.1	70	98.63	0.04	1197
<u></u>	308	586.4	98	99	1105.2	1250.1	71	98.67	0.03	1202
guary shiping parayayan ka mananan manana ka manana ya ka manaya di manaya manaya ka manaya ka manaya ka manay Banaya shiping parayaya ka manaya ka manana ka manaya ka manaya ka manaya ka manaya ka manaya ka manaya ka man		590.5	98	99	1105.2	1250.1	72	98.70	0.03	1207
ementenen variannen antariarriarriarriarriarriarriarriarriarri		595.6		99	1105.2	12.0.1		98.73	0.03	1211
69	317.2	603	98	99	1105.2	1250.1	74	98.76	0.03	1216
LOS materiarias de mante primeira primeira primeira no questos tratas de materiarios de materiarios de materiarios	viviente a a a a a a a a a a a a a a a a a a a	612.3	······································	99	1105.2	1250.1	75	98.80	0.03	1221
innere en	327.7	621.9		99	1105.2	1250.1		98.84	0.04	1227
	334	633.2	99	99	1105.2	1250.1	77	98.88	0.03	1232
		646	98	90	1105.2	1250.1		98.92	0.04	1238
soprania a anno a soma a soma anno a atamena a anno a TA	347.3	657.1	98		1105.2	1250.1	79	98.94	0.03	1242
ensemmente en	353.6	668.5	98	99	1105.2	1250.1	80	98.98	0.03	1247
menter en	the San a series of the series	678.9	······································	99.5	1250.1	1351.2	81	99.01	0.03	1252
on proposition and the second	354.5	688.1		99.5	1250.1	1351.2	82	99.04	0.03	1258
gagaine pagasa a samma mana tamba a mana br>Para a mana a	369,4	696.9	99	99.5	1250.1	1351,2	83	99.06	0.02	1262
$\frac{1}{10^{10}}$		705.7	••••••••••••••••••••••••••••••••••••••	99,5	1250.1	1351.2	84	99.08	0.02	1267
90 ************************************	378.7	713.7	99	99.5	1250.1	1351.2	85	99.10	0.02	1271
	382.8	721	99	99.5	1250.1	1351.2	86	99.13	0.02	1276
internal memorphism period (1991 all ments for all never a statuta e of sendad in the finite and distance and a		727,7	99 99	99,5	1250.1	1351.2	87	99.14	0.01	1279
		733.8	99	99.5	1250.1	1351.2	88	99.16	0.02	1283
purpusamo procedura de la contractiva del la contractiva del la contractiva de la contractiva de la contractiva del la contr	-u-commonweller	739	99	99.5	1250.1	1351.2	89	99.18	0.02	1287
anterioristi interioristi esistete esistete propriorista esistete esistete esistete esistete esistete esistete Anterioristi interioristi esistete esistete esistete esistete esistete esistete esistete esistete esistete esi	392.8 	accertactivillesetretescurigianes		99.5	1250.1	1351.2	90 90	99.21	0.02	1292
85	395.7	744,3	eperate were annual contribution of the property	มะแบบจระจะของเคยขนะจะที่รู้-	1250.1			99.22	0.01	1295
88	398.5	749.3	99	99,5	ageneral establishment of the second of the	garaneas arana arana arana arana da tarta tarta tarta tarta tarta tarta tarta tarta da tarta da de de de de de	anno en	99.24	0.02	1299
. Lewystern Lewysters (natural and anticle recovery were to traditional states (1997) and the second st	AQ 1.4	754.5	oo l	99,5	1250.1	13512	92 unumummanishini 93	99.26		
www.energiana.com.com.com.com.com.com.com.com.com.com	404.7	760.5	99	99.5	1250.1	1351.2	tepseteepenetesteestesnetesbenfensese	-cocurrence-entreprise entreprise (by Grover)	nantaryonnsantaritaisantaritarisis (kinto	cavaque an aqua equa e carefre
	408,4	767.1	99	99.5	1250.1	1351.2	94	99.28	0.02	1306
endendriaenstrangs	innessassassassassassassassassassassassassa	775.9	livanovo to tri portugui participa de	99.5	1250.1	13512 	95	99.30	0.02	1310
	419.6	787.3	99	99.5	1250.1	1351.2	96	99.32	0.02	1314
92	428,2	802.8	99	99.5	1250.1	1351.2	97	99.33	0.01	1317
	440.7	825.3		99.5	1250,1	13512 	98	99.35	0.02	1321
<u>94</u> 	456	052,8	99	99.5	1250.1	1351.2	99	99.37	0.01	1324
en e	475.2	887.4	99	99.5	1250.1	1351,2	100	99.39	0.02	1328
	SO17	935.1	<b>99</b> ]	99.5	1250.1		101	99.40	0.01	1331
97 	538.0	1001.8	99	99.5	1250.1	1351.2	102	99.41	0.01	1334
**************************************	596.2	1105.2	99	99.5	1250.1	1351.2	103	99,43	0.01	1337
gg.	ement of the state	1250.1	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	99.5	1250.1	1351.2	104	99,44	0.01	1340
99.5	732.0	1351.2	99	99,5	1250.1	1351.2	105	99.46	0.01	1343
		unga aga migilang masalan ya Jejima bili 🕏 Simbiri.	99	99.5	1250.1	1351.2	106	99.47	0.01	1346
wintsepossee opposition of stations are service to see a station of service and service an				99.5	1250.1	1351.2	107	99,49	0.01	1349
			99	99,5	1250.1	1351.2	108	99.50	0.01	1351



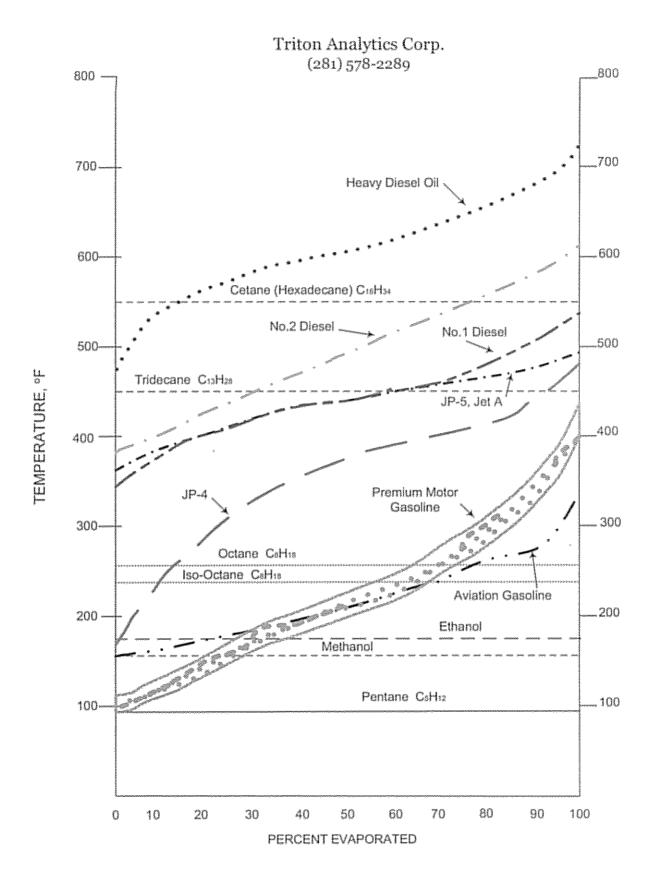




## **Crude Oil Fractions**

Stream Name	<b>Boiling Range</b>	Carbon Number	Disposition
·Off Gas	wa ca mi	1-3	To Sats Gas Plant
·SR Butane	<b>१०० क</b> जरू		To Butane Splitter
·SR Gasoline	70-130	5-6	To Mogas or Isom
·SR Lt Naphtha	120-220	6-7	To Reformer/Arom. Extract
·SR Hvy Naphtha	200-400	7-11	To Reformer/Mogas
·Kerosene	350-500		Jet Fuel via DHT
·SR Lt Gas Oil	450-650	14-20	Diesel/Furnace Oil via DHT
·SR Hvy Gas Oil	600-800	20-25	To Conversion Units
·SR Resid ·Atmos Resid ·Long Resid	800 +	25 +	To Vacuum Flashers/Towers
·Flashed Dist ·Vacuum Gas Oils	800-1050	25-35	Cat Feed To Conversion Units
·Pitch ·Vacuum Resid ·Short Resid	1000 +	35 +	To Asphalt, Residual Fuel, Cokers, Resid Conversion

Note: SR means Straight Run, i.e., from Crude Unit



Distillation Characteristics of Fuels



GSI Job No. G-2876 Issued: January 25, 2005

# APPENDIX C.2 PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL BR-I

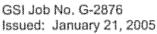
C.2 Physical Properties and Chemical Composition of Oil Sample from Well BR-I (2 pages)

Table C-2: Chemical Composition of Oil Sample from Well BR-I (5 pages)

Physical properties testing results from PTS Laboratories (4 pages)

ASTM D86 Distillation Test results from SPL, Inc. (3 pages)

High Temperature Simulated Distillation (HTSD) results from Triton Analytics Corp. (7 pages)



Page 1 of 2



# C.2 PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL BR-I

On October 27, 2004, personnel from Groundwater Services, Inc. (GSI) collected a sample of oil from well BR-I, which is located at Site I. The oil was reported to have dark brown color and the consistency of motor oil. Results of field measurements indicated a specific gravity of 1.42 and viscosity of 5.5 centistokes at a temperature of 63 °F. The specific gravity measurement and visual observations confirmed that the oil is a DNAPL.

Two 40-mL vials of the oil sample from BR-I were submitted to Severn Trent Laboratories in Savannah, Georgia, for laboratory analysis of VOCs, SVOCs, pesticides, herbicides, PCBs, dioxins/furans, and metals. Analytical results are presented on Table C-2 and summarized below. Approximately 17% of the sample composition by weight was identified by these analytical methods. Copies of laboratory reports are attached.

Chemical Constituents in Oil Sample from BR-I	Reported Concentration (mg/kg)	Weight Fraction (%)
VOCs (total)	702	0.070
1,2-Dichlobenzene	1900	0.19
1,4-Dichlorobenzene	8400	0.84
1,2,4-Trichlorobenzene	140,000	14
Hexachlorobenzene	10,000	1,0
Other SVOCs	758	0.076
Pesticides (total)	1404	0.14
Herbicides (total)	er in programmy programmy and the second control of the control of	0.0087
PCBs (total)	and the property of the control of t	0.15
Dioxins/Furans (total)	25.4*	0.0025
Metals (total)	1879	0.19
Total Weight Fraction	n for Identified Constituents:	16.7%

<sup>\* = 2,3,7,8-</sup>TCDD and 1,2,3,7,8-PeCDD were detected in the oil sample at estimated concentrations of 12 ng/g and 8.5 ng/g, respectively.

A liter bottle containing groundwater and oil was submitted for laboratory analysis of fluid properties at PTS Laboratories in Santa Fe Springs, California. The sample was tested using ASTM D445 and ASTM D1481, which include measurement of: i) dynamic viscosity and fluid density at three temperatures; ii) surface tension for each fluid; and iii) interfacial tension for oil/water, oil/air, and water/air. Results of laboratory testing of the DNAPL sample indicated a specific gravity of 1.44 and viscosity of 5.92 centistokes at a temperature of 70 °F.

An additional volume of sample was submitted to SPL, Inc. of Houston, Texas, for analysis by ASTM Method D86 Distillation. Initial boiling point of the oil was 432 °F, and final boiling point was 530 °F.

GSI Job No. G-2876 Issued: January 21, 2005 Page 2 of 2 GROUNDWATER SERVICES, INC.

A vial of oil from BR-I was submitted to Triton Analytics Corporation of Houston, Texas, for High Temperature Simulated Distillation (HTSD). The HTSD test is a GC technique that separates individual hydrocarbon components in the order of their boiling points, giving a percent mass yield as a function of boiling point. The HTSD test can be used to determine the carbon number distribution up to C120.

Prior to conducting the HTSD test, Triton Analytics centrifuged the contents of the vial to isolate the oil layer. Triton Analytics reported that the sample is likely a synthetic product. Based on the low percent recovery from the test, the sample has a significant component which is either not a hydrocarbon or is insoluble in carbon disulfide. Test results indicated that compounds with carbon numbers of 13 or less comprised approximately 80% of the sample by weight.

**Key Findings**: The oil sample collected from well BR-I was determined to be a DNAPL. Chemical constituents identified by various analytical methods comprised approximately 17 percent of the sample by weight. The predominant identified constituent was 1,2,4-trichlorobenzene, which comprised 14% of the sample by weight.

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# TABLE C-2 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL BR-I

COMPOUND		Result	Units
Volatile Organic Compounds (VOCs) by EPA Method 8260			
1,1,1-Trichloroethane	71-55-6	<10	mg/kg
1,1,2,2-Tetrachioroethane	79-34-5	<10	*
1,1,2-Trichloroethane	79-00-5	<10	**
1,1-Dichloroethane	75-34-3	<10	*
1,1-Dichloroethene	75-35-4	<10	*
1,2-Dichloroethane	107-06-2	<10	*
1,2-Dichloropropane	78-87-5	<10	**
2-Butanone (MEK)	78-93-3	<50	*
2-Hexanone	591-78-6	<50	*
4-Melhyl-2-pentanone (MIBK)	108-10-1	<50	₹
ушеннен принценення принцення принцення принцення принцення принцення принцення принцення принцення принцення Асволе	67-64-1	<100	fig.
Benzane	71-43-2	19	*
Bromodichloromethane	75-27-4	<10	**
Bromoform	75-25-2	<10	*
Bromomethane	74-83-9	<10	*
Carbon Disulfide	75-15-0	<10	#
Carbon Tetrachloride	56-23-5	<10	***
Chlorobenzene	108-90-7	220	*
Chloroethane (ethyl chloride)	75-00-3	<10	*
Chloroform	67-66-3	<10	981
Chloromethane	74-87-3	<10	
cis-1,2-Dichloroethene	156-59-2	<10	**
cis-1,3-Dichloropropene	10061-01-5	<10	*
Dibromochloromethane	124-48-1	<10	#k
Ethyl benzene	100-41-4	350	*
Styrene	100-42-5	<10	*
Tetrachloroethene	127-18-4	38	*
Toluene	108-88-3	27	*
trans-1,2-Dichioroethene	156-60-5	<10	*
trans-1,3-Dichloropropene	10061-02-6	<10	**
Trichloroethene	79-01-6	5.1	*
Vinyl Chloride	75-01-4	<10	*
Xylenes,Total	1330-20-7	43	*
Total VOCs		702	mg/kg

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# TABLE C-2 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL BR-I

COMPOUND	CAS No.	Result	Units
Semivolatile Organic Compounds by EPA Method 8270		Caral Birahawal an at	
1,2,4-Trichlorobenzene	120-82-1	140000	mg/kg
1,2-Dichlorobenzene	95-50-1	1900J	**
1,3-Dichlorobenzene	541-73-1	<71	89)
1,4-Dichlorobenzene	106-46-7	8400	**
2,4,5-Trichlorophenol	95-95-4	<71	*
2,4,6-Trichlorophenol	88-06-2	<71	*
2,4-Dichlorophenol	120-83-2	<71	**
2,4-Dimethylphenol	105-67-9	<71	*
2,4-Dinitrophenol	51-28-5	<370	**
2.4-Dinitrotoluene	121-14-2	<71	**
2,6-Dinitrololuene	606-20-2	<71	*
2-Chloronaphthalene	91-58-7	<71	NA.
2-Chlorophenol	95-57-8	<71	18
2-Methylnaphthalene	91-57-6	84	*
2-Methylphenol (o-Cresol)	95-48-7	<b>*</b> 71	*
2-Nitroaniline	88-74-4	<370	M 
2-Nitrophenol	88-75-5	<71	ale
3,3'-Dichlorobenzidine	91-94-1	<140	m
3-Methylphenol/4-Methylphenol (m&p-Cresol)	106-44-5	<71	79.
3-Nitroaniline	99-09-2	<370	*
4,6-Dinitro-2-methylphenol	oromesamaionaenesseesta muususseesta 1924. 1948–1924	<370	\$1 ************************************
4-Bromophenylphenyl ether	101-55-3	<71	**
4-Chloro-3-methylphenol	59-50-7	<71	98
4-Chloroaniline	106-47-8	<140	.**
4-Chlorophenylphenyl ether	7005-72-3	<b>≺71</b>	24
4-Nitroaniline	100-01-6	<370	entralista en
4-Nitrophenol	100-02-7	<370	39
Acenaphthene	83-32-9	<71	*
Acenaphthylene	208-96-8	<71	100
Anthracene	120-12-7	<71	*
Antiriacene Benzo(a)anthracene	56-55-3	ongogramente in service and a material and a service a	
· ·	50-32-8	₹71	**
Benzo(a)pyrene	205-89-2	₹71	**
Benzo(b)fluoranthene		<71	96
Benzo(g,h,i)perylene	191-24-2	<71	*
Benzo(k)fluoranthene	207-08-9	organisaminasisminasisminasisminasisminasisminasisminasisminasisminasisminasisminasisminasisminasisminasismina Ali	*
bis(2-Chloroethoxy)methane	111-01-1		
bis(2-Chloroethyl)ether	111-44-4	<71	~: ***
bis(2-Ethylhexyl)phthalate	117-81-7	<71	2T
Butylbenzylphthalate	85-68-7	<71	, no
Carbazole	<u>86-74-</u> 8	£ 1 pricesummensummunicumurus en	
Chrysene	218-01-9	<71	*
Dibenzo(a,h)anthracene	53-70-3	<71	**
Dibenzoluran	132-64-9	<71	*
Diethylphthalate	84-66-2	<71	*
Omethylphthalate	131-11-3	<71	

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# TABLE C-2 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL BR-I

COMPOUND	CAS No.	Result	Units
Semivolatile Organic Compounds by EPA Method 8270			
Di-n-butylphthalate	84-74-2	<71	mg/kg
Di-n-octylphthalate	117-84-0	<71	99
Dinoseb	88-85-7	<71	*
Fluoranthene	206-44-0	<71	聯
Fluorene :	86-73-7	<71	396
Hexachlorobenzene	118-74-1	10000	*
Hexachlorobutadiene	87-68-3	<71	<b>X0</b>
Hexachlorocyclopentadiene	77-47-4	<71	86
Hexachloroethane	67-72-1	<71	98
Indeno(1,2,3-cd)pyrana	193-39-5	<71	98
Isophorone	78-59-1	<b>471</b>	*
Naphthalene	91-20-3	620	29
Nitrobenzene	98-95-3	<71	**
N-Nitroso-di-n-propylamine	621-64-7	<71	96
N-Nitrosodiphenylamine	86-30-6	<71	**
Pentachlorophenol	87-88-5	<270	**************************************
Phenanthrene	85-01-8	<71	**
Phenol	108-95-2	<71	899
Pyrane	129-00-0	54J	36
· Total SVOCs		160000	inamenten in
Metals by EPA Method 6010	n varanga namas katikati nama		
Silver Silver	7440-22-4	<0.93	mg/kg
Aluminum	7429-90-5	24	109
Arsenic	7440-38-2	<0.93	99
Barium	7440-39-3	18	*
Beryllium	7440-41-7	<0.37	**
Calcium	7440-70-2	1600	議 ;asishidaniaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
Cadmium	7440-43-9	<0.46	98
Cobalt	7440-48-4	1.5	#9
Chromium	7440-47-3	15	**
Copper	7440-50-8	11	34
lion	7439-89-8	55	managaramagaragaragaragaragaragaragaragarag
Potassium	7440-09-7	<93	34
Magnesium	7439-95-4	97	<b>34</b>
Sodium	7440-23-5	<46	*
Nickel	7440-02-0	43	18
<u>kant</u>	7439-92-1	2,2	
Antimony	7440-36-0	<1.9	184
· ·	3	<0.93	198
Selenium	7782-49-2	**************************************	
Selenium Thallium	7782-49-2 7440-28-0	<0.93	39
		ž	**
Thallium	7440-28-0	<0.93	
Thallium Vanadium	7440-28-0 7440-62-2	<0.93 5.1	en e

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# TABLE C-2 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL BR-I

COMPOUND	CAS No.	Result	Units
Pesticides by EPA Method 8081			
4,4'-000	72-54-8	<320	mg/kg
4,4'-DDE	72-55-9	<320	*
4,4-001	50-29-3	<320	*
Aldrin	309-00-2	<160	394
alpha-BHC	319-84-6	1300P	19
alpha-Chlordane	5103-71-9	<160	N
beta-BHC	319-85-7	78JP	<b>\$</b> \$
delta-BHC	319-86-8	<160	<b>\$</b> \$
Diektrin	60-57-1	<320	#
Endosulfan I	959-98-8	<160	*
Endosulfan II	33213-65-9	<320	9
Endosulfan sulfate	1031-07-8	<320	#
Endrin	72-20-8	<320	**
Endrin aldehyde	7421-93-4	<320	#
Endrin ketone	53494-70-5	<320	**
gamma-BHC (Lindane)	58-89-9	26JP	*
gamma-Chlordane	5103-74-2	<160	#
Heptachlor	76-44-8	<160	*
Heptachior epoxide	1024-57-3	<160	39.
Methoxychior	72-43-5	<1600	<del>3</del> 8
Toxaphene	8001-35-2	<16000	<del>9</del> 9
Total SVOCs		1400	mg/kg
Chlorinated Herbicides by EPA Method 8151			
2,4,9-1	93-76-5	23	mg/kg
2,4,5-TP (Siivex)	93-72-1	<3	*
2,4-D	94-75-7	21P	*
2,4-DB	94-82-6	<3	26
Dalapon	75-99-0	<600	*
Dicamba	1918-00-9	<6	#
Dichloroprop	120-36-5	<30	*
MCPA((4-chloro-2-methylphenoxy)-acetic acid)	94-74-6	<600	**
MCPP[2-(4-chloro-2-methylphenoxy)-propanoic acid]	93-65-2	<600	**
Pentachlorophenol	87-86-5	43P	#
Total Herbicides		87	mg/kg
Polychlorinated Biphenyls (PCBs) By EPA Method 8082			Marin Walter and State of the S
Aroclor-1016	12674-11-2	<3200	mg/kg
Aroclor-1221	11104-28-2	<6400	養
Arocior-1232	11141-16-5	<3200	樂
<u> </u>	53469-21-9	<3200	## 
Arodor-1248	12672-29-6	<3200	#
Arocior-1254	11097-69-1	<3200	***
Arodor-1260	11096-82-5	1500JP	*
Total PCBs		1500	mg/kg

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## TABLE C-2 CHEMICAL COMPOSITION OF OIL SAMPLE FROM WELL BR-I

## Sauget Area 1 Sauget and Cahokia, Illinois

COMPOUND	CAS No.	Result	Units
Dioxins and Furans By EPA Method 8280A			
2,3,7,8-TCDD	1746-01-6	12 JA	ng/g
Total TCDD	707	58	
1,2,3,7,8-PeCDD	40321-76-4	8.5 J	*
Total PeCDD	***************************************	300	*
1,2,3,4,7,8-HxCDD	39227-28-6	6.3 J	*
1,2,3,6,7,8-HxCDD	57653-85-7	49	*
1,2,3,7,8,9-HxCDD	19408-74-3	16	*
Total HxCDD		400	
1,2,3,4,6,7,8-HpCOD	35822-39-4	1100 E	*
Total HpCDD	100	2600	*
OCOD	3268-87-9	12000 E	
2,3,7,8-TCDF	51207-31-9	58	*
Total TCDF	#	220	#
1,2,3,7,8-PeCDF	57117-41-6	6.9 J	*
2,3,4,7,8-PeCDF	57117-31-4	26	*
Total PeCDF		460	*
1,2,3,4,7,8-HxCDF	70648-26-9	380 E	*
1,2,3,6,7,8-HxCDF	57117-44-9	42	*
2,3,4,6,7,8-HxCDF	60851-34-5	10 J	
1,2,3,7,8,9-HxCDF	72918-21-9	<3.8	
Total HxCDF		1700	*
1,2,3,4,6,7,8-HpCDF	67562-39-4	980 E	**
1,2,3,4,7,8,9-HpCDF	55673-89-7	130	**
Total HpCDF	THE COLUMN TWO IS NOT	2500	9
OCOF	39001-02-0	5200 E	
Total Dioxins and Furans		25430	ng/g

#### Notes:

- 1. The oil sample was collected from BR-I on Oct 27, 2004.
- 2. All analyses were conducted by Severn Trent Laboratories (STL), Savannah, Georgia. Detected analytes are presented in bold type.
- 3, J = Analyted detected below the reporting limit but above the method detection limit (MDL).
  - < = Analyte not detected at the specified reporting limit. B = Reported value was obtained from a reading that was less than the project reporting limit but greater than or equal to the method detection limit.
  - E = Estimated result. Result exceeds the calibration range.
- P = Identification of target analytes using GC methodology is based on retention time. Although two dissimilar GC columns confirmed the presence of target analyte in sample, relative percent difference is >40%. Thus, viewer discretion should be employed during data review and interpretation of results for this target compound.
- JA = The analyte was positively identified, but the quantitation is an estimate.



November 24, 2004

James A. Kearley Groundwater Services, Inc. 2211 Norfolk, Suite 1000 Houston, Texas 77098

Re:

Fluid Properties Data

PTS File No: 34379; GSI Job No. G-2876

DNAPL Characterization Study, Sauget Area 1 Sites, Sauget Illinois

Dear Mr. Kearley:

Please find enclosed Fluid Properties Data from analyses conducted upon fluids received from your Sauget Area 1 project. An electronic version of the data has previously been sent to your attention via the Internet. All analyses were performed by applicable ASTM, EPA or API methodologies. The remaining fluids are currently in storage and will be disposed at sixty days from project completion.

PTS Laboratories, Inc. appreciates the opportunity to be of service. If you have any questions or require additional information, please give me a call at (562) 907-3607.

Sincerely,

PTS Laboratories, Inc.

Michael Mark Brady, R.G.

Project Manager

Encl.

## VISCOSITY, SPECIFIC GRAVITY and DENSITY DATA

(METHODOLOGY: ASTM D1481, ASTM D445, API RP40)

PROJECT NAME: DNAPL Characterization Study, Sauget Area 1 Sites, Sauget Illinois

PROJECT NO: GSI Job No. G-2876

SAMPLE		TEMP.,	SPECIFIC	DENSITY	VISCO	SITY
ID .	MATRIX	(*F)	GRAVITY	(g/cc)	(centistokes)	(centipolse)
BR-I (water)	Water	70	1.0003	0.9983	1.005	1.003
		100	1.0026	0.9956	0.700	0.697
		130	1.0054	0.9913	0.535	0,530
BR-I (NAPL)	NAPL	70	1.4449	1,4420	5.92	8,54
		100	1.4395	1,4295	3.87	5.53
		130	1,4335	1,4134	2.50	3,66

Groundwater Services, Inc. PTS File No: 34379

PTS Laboratories

## **INTERFACIAL / SURFACE TENSION DATA**

(METHODOLOGY: DuNuoy Method - ASTM D971)

PROJECT NAME:

DNAPL Characterization Study, Sauget Area 1 Sites, Sauget Illinois

PROJECT NO:

GSI Job No. G-2876

presentation of the second	PHASI SAMPLE ID / PHASE	E PAIR SAMPLE ID / PHASE	TEMP., (F)	INTERFACIAL TENSION, (Dynes/centimeter)
	BR-I (water)	Air	71	65.7
	BR-I (NAPL)	Air	71	33,8
	BR-I (water)	BR-I (NAPL)	71	15.0

### QUALITY CONTROL DATA

PHASE PAIR: DI WATER / AIR

TEMPERATURE, °F: 71

IFT, MEASURED: 73.2

IFT, PUBLISHED: 72.5

RPD: 1.01

Serial Number 4 505

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#### HOUSTON LABORATORIES

8820 INTERCHANGE DRIVE HOUSTON, TEXAS 77054 PHONE (713) 860-0301

## Certificate of Analysis

Number:

1030-2004110052-001A

James Kearley

Groundwater Services, Inc. 2211 Norfolk Ste 1000 Houston TX 77098 November 10, 2004

16:40

Sample ID:

Station Name:

BR-I (NAPL)

Station Number : Location; Sample Point: G-2876

Sauget, IL Sauget Area 1 Sampled By:

Sample Of:

R.E Liquid

10/27/2004

Sample Date: Sample Conditions:

PO / Ref. No:

G-2876

#### ANALYTICAL DATA

**ASTM D86 Distillation** 

% Recovery	* F @ 771 mm Hg	Lab Tech.	Date Analyzed
Initial Boiling Point	210	MES	11/10/04
8	432		
10	452		
20	458		
30	468		
40	478		
50	484		
60	498		
70	508		
80	514		
90	NR		
95	NR		
Final Boiling Point	530		
Volume % Recovery	88.0		
Volume% Residue	10.0		
Volume % Loss	2.0		

Comments:

Visual color is crude. Loss and Residue observed.

Temperatures uncorrected for barometric pressure. Initial boiling point indicative of water in sample.

Organic IBP would be temperature closer to 5% recovery point.

Sample On: 10/27/2004 16:40

Hydrocarbon Laboratory Manager

Quality Assurance: The above analyses are performed in accordance with ASTM, UOP or GPA guidelines for quality assurance,



#### HOUSTON LABORATORIES

8820 INTERCHANGE DRIVE HOUSTON, TEXAS 77854 PHONE (713) 889-8901

# Certificate of Analysis

Number:

1030-2004110052-001A

James Kearley

Groundwater Services, Inc. 2211 Norfolk Ste 1000 Houston TX 77098 November 10, 2004

Sample ID:

Station Name:

BR-I (NAPL)

Station Number :

Location: Sample Point: Sauget, IL

Sauget Area 1

Sampled By:

Sample Of: Sample Date:

Sample Condition:

Sample Condition PO / Ref. No:

No G.o

Liquid 10/27/2004 16

16:40

G-2876

R.E

#### ANALYTICAL DATA

			**************************************	(1000-100)	***************************************	
Test	Method	Result	Unit	Detection	Lab	Date
			***************************************	Limit	Tech.	Analyzed
Water in Crude Oil by Distillation	ASTM-D-4006	2.075	voi%	99999991111111111111111111111111111111	MES	11/05/04

#### Comments:

Sample On: 10/27/2004 16:40

Dob Kannali

Hydrocarbon Laboratory Manager

Quality Assurance: The above analyses are performed in accordance with ASTM, UOP or GPA guidelines for quality assurance, unless otherwise stated,

	Other (1) 2. Relinquished by:   December   1/2-34   1/600   6. Received by Laboratory;   1/2-34   1/600   6. Received by Laboratory;   1/2-34   1/600		The Grandship Supplied by Supplied Williams Will	Sumind & O Lord 1 & O Lord 1 & O	Requested TAT Special Reporting Requirements Fax Results [ ] Raw Data [ Special Retection Limits (specify):	250					TO A CART TO STAN A COLO I TO	TIME comp Tab Wiscomp Tab Wisc	plas glas Il lit 80z HCI H12S mbe	tter dge tic s er 4 l	S=0: A=V= V= A: 6=1 Cor 86: IIIn	Soil and Soi	ber illinosis	Slass vial	77.5	Analysis Request & Chain of Custody Record	SPL, Iric. SPL Workstein No.
dor Caffery Parkway, Scott, LA 70583		S. Mennistrad by:									Ž Z	*		· 10					requested Analys		

### 16840 Barker Springs #302 Houston, Texas 77084

(281) 578-2289 (281) 578-2295 villalanti@earthlink.net



## Triton Analytics Corp.

Reference Laboratories

- Hvdrocarbon
- Chemical
- Environmental

Eax:

Dan Villalanti, Pres. • Joe Raia, Lab Director • Calvin Blakley, Mass Spec •

Jeanne Mallov, GC

November 4, 2004

Laboratory Reference: TAC 3973(A)

James Kearley Groundwater Services, Inc. 2211 Norfolk, Suite 1000 Houston, TX 77098

Sample ID: BR-I (NAPL) 10/27/04

Reference: DNAPL Characterization Study at Sauget Area 1 Sites, Sauget, IL

Dear Mr. Kearley:

The High-temperature Simulated Distillation (HTSD) results for your sample identified below are enclosed and were reported to you earlier by Email 11/03/04.

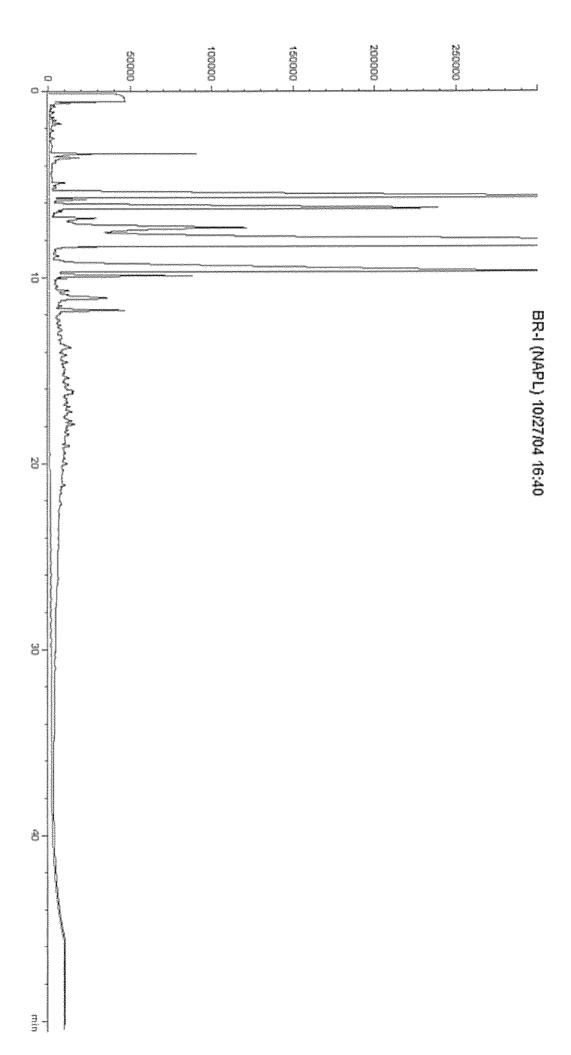
BR-I (NAPL)10/27/04

This sample is likely a synthetic product and based upon the low recovery, appears to have a significant component which is either not hydrocarbon or is insoluble in CS2. Upon centrifugation, there was no appreciable phase separation. We took the liberty of adding two drops of a proprietary demulsifier provided by Baker Petrolite to see if we could improve separation. As demonstrated by the photo, the sample with demulsifier has more sediment and less rag layer.

Thank you and please let us know if you have any questions.

Regards,

DCV/kst Enclosures



AC Software version M2.5 Simdis HT 750 Analyzer

Data File Name: C:\HPCHEM\1\DATA\1102A\005F0801.D

Instrument : 1

Operator : Triton Analyt.

Acquired on : 03 Nov 04 01:39 AM Seq. line : 8

Processed on : 03 Nov 04 3:30 PM

Sample name : BR-INAPL1027 Sample Amt: 0.1090 Methodname : MHC30.MTH ISTD amt : 0.0000 Calc. Based On: ESTD Weight CS2: 4.8569

Sequencename : 1102A Cryogenic sequence

Blank used : C:\HPCHEM\1\DATA\1102A\007F1001.D BP Calib. used: C:\HPCHEM\1\DATA\1102A\090F0101.D Reference used: C:\HPCHEM\1\DATA\1102A\095F0301.D

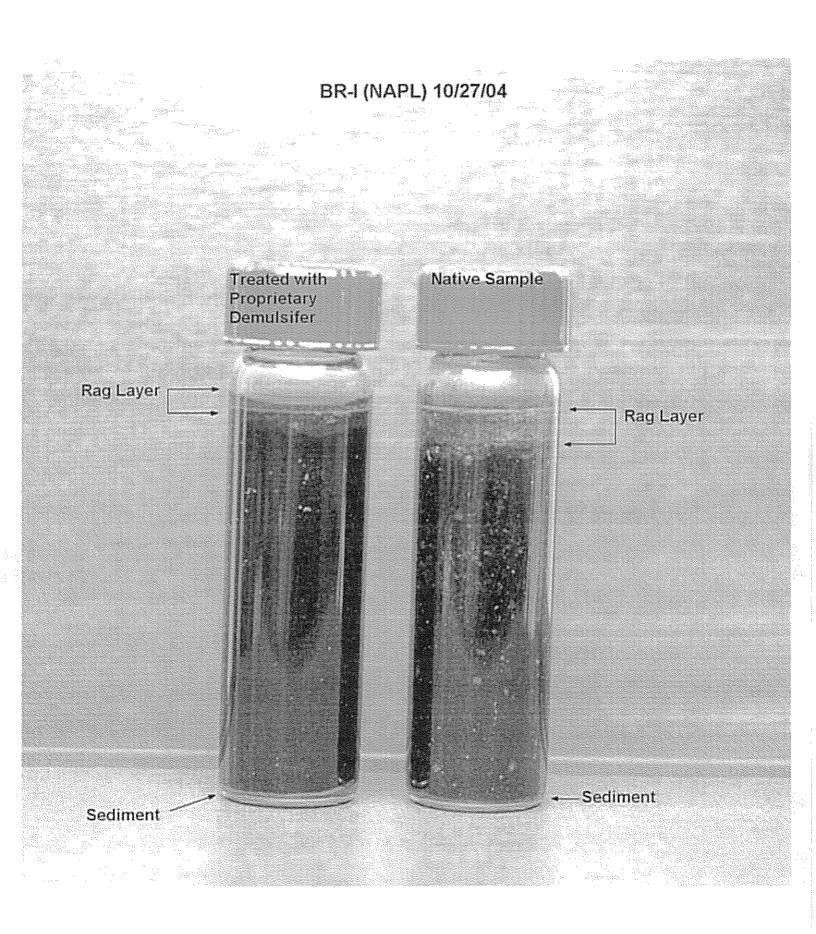
Recovery(%) : 47.7 found, 100% recovery assumed

Analysis results: %Weight versus Boiling point BP(F) & 
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% Weight

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GSI Job No. G-2876 Issued: January 21, 2005

# APPENDIX C.3 CHEMICAL COMPOSITION OF GROUNDWATER SAMPLE FROM WELL BR-G

C.3 Chemical Composition of Groundwater Sample from BR-G (one page)

GSI Job No. G-2876 Issued: January 21, 2005

Page 1 of 1



#### C.3 CHEMICAL COMPOSITION OF GROUNDWATER SAMPLE FROM BR-G

On October 30, 2004, personnel from Groundwater Services, Inc. (GSI) attempted a DNAPL recovery test at well BR-G. No DNAPL could be recovered for laboratory analysis, but a groundwater sample was collected immediately prior to the conclusion of the DNAPL recovery test. Droplets of DNAPL were noted in the Waterra tubing when it was removed from BR-G at the conclusion of the recovery test.

The groundwater sample from BR-G was submitted to Severn Trent Laboratories in Savannah, Georgia, for laboratory analysis of VOCs and SVOCs. A copy of the laboratory report is attached. The following table lists all VOCs and SVOCs that were detected in this groundwater sample.

	Reported Concentration (mg/L)
VOCs by EPA 8260	90.00
Benzene	0.076
Chlorobenzene	0.15
cis-1,2-Dichloroethene	0.011
trans-1,2-Dichloroethene	0.0041 J
MIBK	0.092 J
SVOCs by EPA 8270	
1,4-Dichlorobenzene	5.3
1,2,4-Trichlobenzene	0.18 J
Phenol	0.24 J
2-Chlorophenol	0.035 J
4-Chloroaniline	0.12 J

J = Compound meets the identification criteria, but result is less than sample reporting limit and greater than the method detection limit.

The presence of these constituents in the groundwater sample from BR-G may be due to dissolution of these constituents from DNAPL droplets in well BR-G. Alternatively, the VOCs and SVOCs detected in this groundwater sample could have originated from a location upgradient of well BR-G.